

K141055  
JUN 13 2014

## 510(k) Summary of Safety and Effectiveness

*This summary of 510(k) safety and effectiveness information is being submitted in accordance with the requirements of SMDA 1990 and 21 CFR 807.92.*

### Introduction

According to the requirements of 21 CFR 807.92, the following information provides sufficient detail to understand the basis for a determination of substantial equivalence.

### Submitter Name, Address, and Contact:

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### Device Name and Classification

Classification Name: Enzyme Immunoassay, Hydrocodone  
Class II, DJG (91 Toxicology),  
21 CFR 862.3650

Drug Specific Calibrators,  
Class II, DLJ (91 Toxicology),  
21 CFR 862.3200

Drug Specific Controls,  
Class I, LAS (91 Toxicology),  
21 CFR 862.3280

Common Name: Homogeneous Hydrocodone Enzyme Immunoassay  
Proprietary Name: LZI Hydrocodone Enzyme Immunoassay,  
LZI Hydrocodone Drugs of Abuse (DAU) Calibrators  
LZI Hydrocodone Drugs of Abuse (DAU) Controls

## **Legally Marketed Predicate Device(s)**

The LZI Hydrocodone Enzyme Immunoassay (EIA) is substantially equivalent to the Lin-Zhi International, Inc. Oxycodone Enzyme Immunoassay (k120763) manufactured by Lin-Zhi International, Inc. The LZI Hydrocodone Enzyme Immunoassay is identical or similar to its predicate in terms of intended use, method principle, device components, and clinical performance.

## **Device Description**

The LZI Hydrocodone assay is a homogeneous enzyme immunoassay with ready-to-use liquid reagents. The assay is based on competition between drug in the sample and drug labeled with the enzyme glucose-6-phosphate dehydrogenase (G6PDH) for a fixed amount of antibody in the reagent. Enzyme activity decreases upon binding to the antibody, and the drug concentration in the sample is measured in terms of enzyme activity. In the absence of drug in the sample, hydrocodone-labeled G6PDH conjugate is bound to antibody, and the enzyme activity is inhibited. On the other hand, when free drug is present in the sample, antibody would bind to free drug; the unbound hydrocodone-labeled G6PDH then exhibits its maximal enzyme activity. Active enzyme converts nicotinamide adenine dinucleotide (NAD) to NADH, resulting in an absorbance change that can be measured spectrophotometrically at 340 nm.

The LZI Hydrocodone Enzyme Immunoassay is a kit comprised of two reagents, an R<sub>1</sub> and R<sub>2</sub>, which are bottled separately but sold together within the kit.

The R<sub>1</sub> solution contains mouse monoclonal anti-hydrocodone antibody, glucose-6-phosphate (G6P) nicotinamide adenine dinucleotide (NAD), stabilizers, and sodium azide (0.09%) as a preservative. The R<sub>2</sub> solution contains glucose-6-phosphate dehydrogenase (G6PDH) labeled with hydrocodone in buffer with sodium azide (0.09%) as preservative.

The LZI Hydrocodone Enzyme Immunoassay calibrators and controls designated for use at the 100 ng/mL cutoff contain 0, 50, 75, 100, 125, 150, and 300 ng/mL of hydrocodone in human urine with sodium azide (0.09%) as preservative. These five calibrators and two controls are sold as individual bottles.

The LZI Hydrocodone Enzyme Immunoassay calibrators and controls designated for use at the 300 ng/mL cutoff contain 0, 150, 225, 300, 375, 500, and 800 ng/mL of hydrocodone in human urine with sodium azide (0.09%) as preservative. These five calibrators and two controls are sold as individual bottles.

## **Intended Use**

The LZI Hydrocodone Enzyme Immunoassay is intended for the qualitative and semi-quantitative determination of hydrocodone in human urine at the cutoff values of 100 and 300 ng/mL. The assay is designed for prescription use with a number of automated clinical chemistry analyzers.

The semi-quantitative mode is for purposes of (1) enabling laboratories to determine an appropriate dilution of the specimen for confirmation by a confirmatory method such as GCMS and LCMS or (2) permitting laboratories to establish quality control procedures.

The LZI Hydrocodone Drugs of Abuse (DAU) Calibrators are for use as calibrators in the qualitative and semi-quantitative calibration of the LZI Hydrocodone Enzyme Immunoassay at the cutoff values of 100 and 300 ng/mL.

The LZI Hydrocodone Drugs of Abuse (DAU) Controls are for use as assayed quality control materials to monitor the precision of the LZI Hydrocodone Enzyme Immunoassay at the cutoff values of 100 and 300 ng/mL.

***The assay provides only a preliminary analytical result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas or liquid chromatography/mass spectrometry (GC/MS or LC/MS) is the preferred confirmatory method. Clinical consideration and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary test result is positive.***

## Comparison to Predicate Device

The LZI Hydrocodone Enzyme Immunoassay is substantially equivalent to the Lin-Zhi International, Inc. Oxycodone Enzyme Immunoassay, Calibrators and Controls for Hitachi 717 Systems cleared by the FDA under the premarket notification k120763 for its stated intended use.

The following table compares LZI's Hydrocodone Enzyme Immunoassay with the predicate device.

<b>Device Characteristics</b>	<b>Subject Device</b> LZI Hydrocodone Enzyme Immunoassay, Calibrators and Controls	<b>Predicate Device (k120763)</b> LZI Oxycodone Enzyme Immunoassay, Calibrators and Controls
<b>Intended Use</b>	<p>The LZI Hydrocodone Enzyme Immunoassay, when used in conjunction with the AU480 automated clinical system analyzers, is intended for the qualitative and semi-quantitative determination of hydrocodone in human urine at cutoff values of 100 or 300 ng/mL. The assay is designed for professional use with a number of automated clinical chemistry analyzers.</p> <p><i>This assay provides a rapid screening procedure for determining the presence of hydrocodone and hydromorphone in urine. The assay provides only a preliminary analytical result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas or liquid chromatography/mass spectrometry (GC/MS or LC/MS) is the preferred confirmatory method. Clinical consideration and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary test result is positive.</i></p>	<p>The LZI Oxycodone Enzyme Immunoassay, when used in conjunction with Hitachi 717 automated clinical system analyzers, is intended for the qualitative and semi-quantitative determination of oxycodone and oxymorphone in human urine at cutoff values of 100 or 300 ng/mL. The assay is designed for professional use with a number of automated clinical chemistry analyzers.</p> <p><i>This assay provides a rapid screening procedure for determining the presence of oxycodone and oxymorphone in urine. The assay provides only a preliminary analytical result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas or liquid chromatography/mass spectrometry (GC/MS or LC/MS) is the preferred confirmatory method. Clinical consideration and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary test result is positive.</i></p>
<b>Analyte</b>	Hydrocodone	Oxycodone
<b>Cutoff</b>	100 or 300 ng/ml	100 or 300 ng/ml
<b>Matrix</b>	Urine	Urine
<b>Calibrators Level</b>	100 ng/mL Cutoff: 5 Levels 0, 50, 100, 150, and 300 ng/mL 300 ng/mL Cutoff: 5 Levels 0, 150, 300, 500, and 800 ng/mL	0, 50, 100, 300, 500, and 800 ng/mL
<b>Controls Level</b>	100 ng/mL Cutoff: 2 Levels (75 ng/mL, 125 ng/mL) 300 ng/mL Cutoff: 2 Levels (225 ng/mL, 375 ng/mL)	100 ng/mL Cutoff: 2 Levels (75 ng/mL, 125 ng/mL) 300 ng/mL Cutoff: 2 Levels (225 ng/mL, 375 ng/mL)
<b>Storage</b>	2-8 °C until expiration date	2-8 °C until expiration date

## Performance Characteristics Summary:

AU480 Analyzer

### Precision: 100 ng/mL Cutoff

#### Semi-Quantitative Positive/Negative Results:

The following concentrations were determined with reference curves from 5 calibrators. Typical results were measured as ng/mL. Positive/Negative results are as follows:

100 ng/mL Cutoff Result:		Within Run (N=22)		Total Precision (N=88)	
Hydrocodone Concentration	% of Cutoff	Number of Determination	Immunoassay Result	Number of Determination	Immunoassay Result
0 ng/mL	-100.0%	22	22 Negative	88	88 Negative
25 ng/mL	-75.0%	22	22 Negative	88	88 Negative
50 ng/mL	-50.0%	22	22 Negative	88	88 Negative
75 ng/mL	-25.0%	22	22 Negative	88	88 Negative
100 ng/mL	100.0%	22	8 Pos/14 Neg	88	43 Pos/45 Neg
125 ng/mL	+25.0%	22	22 Positive	88	88 Positive
150 ng/mL	+50.0%	22	22 Positive	88	88 Positive
175 ng/mL	+75.0%	22	22 Positive	88	88 Positive
200 ng/mL	+100.0%	22	22 Positive	88	88 Positive

#### Qualitative Positive/Negative Results:

The following concentrations were evaluated. Typical qualitative results were measured as  $\Delta$ OD (mAu). Positive/Negative results are as follows:

100 ng/mL Cutoff Result:		Within Run (N=22)		Total Precision (N=88)	
Hydrocodone Concentration	% of Cutoff	Number of Determination	Immunoassay Result	Number of Determination	Immunoassay Result
0 ng/mL	-100.0%	22	22 Negative	88	88 Negative
25 ng/mL	-75.0%	22	22 Negative	88	88 Negative
50 ng/mL	-50.0%	22	22 Negative	88	88 Negative
75 ng/mL	-25.0%	22	22 Negative	88	88 Negative
100 ng/mL	100.0%	22	7 Pos/ 15 Neg	88	28 Pos/60 Neg
125 ng/mL	+25.0%	22	22 Positive	88	88 Positive
150 ng/mL	+50.0%	22	22 Positive	88	88 Positive
175 ng/mL	+75.0%	22	22 Positive	88	88 Positive
200 ng/mL	+100.0%	22	22 Positive	88	88 Positive

## Performance Characteristics Summary: (continued)

AU480 Analyzer

### Precision: 300 ng/mL Cutoff

#### Semi-Quantitative Positive/Negative Results:

The following concentrations were determined with reference curves from 5 calibrators. Typical results were measured as ng/mL. Positive/Negative results are as follows:

300 ng/mL Cutoff Result:		Within Run (N=22)		Total Precision (N=88)	
Hydrocodone Concentration	% of Cutoff	Number of Determination	Immunoassay Result	Number of Determination	Immunoassay Result
0 ng/mL	-100.0%	22	22 Negative	88	88 Negative
75 ng/mL	-75.0%	22	22 Negative	88	88 Negative
150 ng/mL	-50.0%	22	22 Negative	88	88 Negative
225 ng/mL	-25.0%	22	22 Negative	88	88 Negative
300 ng/mL	100.0%	22	14 Pos/ 8 Neg	88	47 Pos/ 41 Neg
375 ng/mL	+25.0%	22	22 Positive	88	88 Positive
450 ng/mL	+50.0%	22	22 Positive	88	88 Positive
525 ng/mL	+75.0%	22	22 Positive	88	88 Positive
600 ng/mL	+100.0%	22	22 Positive	88	88 Positive

#### Qualitative Positive/Negative Results:

The following concentrations were evaluated. Typical qualitative results were measured as  $\Delta OD$  (mAu). Positive/Negative results are as follows:

300 ng/mL Cutoff Result:		Within Run (N=22)		Total Precision (N=88)	
Hydrocodone Concentration	% of Cutoff	Number of Determination	Immunoassay Result	Number of Determination	Immunoassay Result
0 ng/mL	-100.0%	22	22 Negative	88	88 Negative
75 ng/mL	-75.0%	22	22 Negative	88	88 Negative
150 ng/mL	-50.0%	22	22 Negative	88	88 Negative
225 ng/mL	-25.0%	22	22 Negative	88	88 Negative
300 ng/mL	100.0%	22	11 Pos/11 Neg	88	51 Pos/37 Neg
375 ng/mL	+25.0%	22	22 Positive	88	88 Positive
450 ng/mL	+50.0%	22	22 Positive	88	88 Positive
525 ng/mL	+75.0%	22	22 Positive	88	88 Positive
600 ng/mL	+100.0%	22	22 Positive	88	88 Positive

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### Linearity: 100 ng/mL Cutoff

To demonstrate linearity for purposes of sample dilution and quality control (see semi-quantitative results section) over the entire assay range, a drug free–urine pool spiked with hydrocodone at 300 ng/mL was serially diluted. Each sample was run in 10 replicates on the AU480 instrument and the average was used to determine percent recovery compared to the expected target value. When comparing the result (y) and target (x) value, using the least squares regression technique, the regression equation and correlation are as follow:

$$y = 1.0139x - 1.174, r^2 = 0.9995$$

Target Concentration (ng/mL)	Determined (ng/mL)	% Recovery
300	299.0	99.7%
250	254.2	101.7%
200	205.6	102.8%
175	177.3	101.3%
150	152.6	101.7%
125	124.9	99.9%
100	98.2	98.2%
75	73.3	97.8%
50	48.1	96.1%
25	24.1	96.4%
5	3.7	73.6%
0	0.4	N/A

#### Linearity: 300 ng/mL Cutoff

To demonstrate linearity for purposes of sample dilution and quality control (see semi-quantitative results section) over the entire assay range, a drug free–urine pool spiked with hydrocodone at 800 ng/mL was serially diluted. Each sample was run in 10 replicates on the AU480 instrument and the average was used to determine percent recovery compared to the expected target value. When comparing the result (y) and target (x) value, using the least squares regression technique, the regression equation and correlation are as follow:

$$y = 1.0316x + 1.1461, r^2 = 0.9988$$

Target Concentration (ng/mL)	Determined (ng/mL)	% Recovery
800	806.3	100.8%
700	736.9	105.3%
600	634.2	105.7%
500	510.1	102.0%
425	445.5	104.8%
375	393.2	104.9%
300	304.4	101.5%
225	230.7	102.5%
150	152.9	101.9%
100	104.0	104.0%
10	12.5	124.6%
0	0.5	N/A

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### Method Comparison - Clinical Samples: 100 ng/mL Cutoff

Eighty (80) unaltered clinical urine specimens were tested with the LZI Hydrocodone Enzyme Immunoassay and confirmed with GC/MS or LC/MS. Specimens having a hydrocodone and hydromorphone total concentration greater than 100 ng/mL by GC/MS or LC/MS are defined as positive, and specimens with total concentrations below 100 ng/mL by GC/MS or LC/MS are defined as negative in the table below. The correlation results are summarized as follows: (near cutoff samples are defined as  $\pm 50\%$  of the cutoff value). Adjusted Total hydrocodone and hydromorphone GC/MS or LC/MS values corrected for cross-reactivity (Hydrocodone Cross = 100%, Hydromorphone Cross = 85%) were compared with the EIA result.

#### Semi-Quantitative & Qualitative Data:

100 ng/mL Cutoff	Neg	< 50 % of the cutoff	Near Cutoff Neg.	Near Cutoff Pos.	High Pos.	% Agree-ment
Positive	0	0	3*	5	32	92.5 %
Negative	20	4	13	3**	0	92.5 %

100 ng/mL Cutoff	GC/MS or LC/MS	LZI EIA	Adjusted Total Hydrocodone + Hydromorphone GC/MS or LC/MS (ng/mL)	LZI EIA (ng/mL)
Sample #37*	-	+	85.1	100.5
Sample #39*	-	+	97.0	105.4
Sample #40*	-	+	97.0	101.6
Sample #44**	+	-	128.8	93.1
Sample #45**	+	-	138.5	93.7
Sample #46**	+	-	146.5	88.1

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### Method Comparison - Clinical Samples: 300 ng/mL Cutoff

Eighty (80) unaltered clinical urine specimens were tested with the LZI Hydrocodone Enzyme Immunoassay and confirmed with GC/MS or LC/MS. Specimens having a hydrocodone and hydromorphone total concentration greater than 300 ng/mL by GC/MS or LC/MS are defined as positive, and specimens with total concentrations below 300 ng/mL by GC/MS or LC/MS are defined as negative in the table below. The correlation results are summarized as follows: (near cutoff samples are defined as  $\pm 50\%$  of the cutoff value). Adjusted Total hydrocodone and hydromorphone GC/MS or LC/MS values corrected for cross-reactivity (Hydrocodone Cross = 100%, Hydromorphone Cross = 78%) were compared with the EIA result.

#### Semi-Quantitative & Qualitative Data:

300 ng/mL Cutoff	Neg	< 50 % of the cutoff	Near Cutoff Neg.	Near Cutoff Pos.	High Pos.	% Agreement
Positive	0	0	2*	6	32	95.0 %
Negative	20	12	6	2**	0	95.0 %

300 ng/mL Cutoff	GC/MS or LC/MS	LZI EIA	Adjusted Total Hydrocodone + Hydromorphone GC/MS or LC/MS (ng/mL)	LZI EIA (ng/mL)
Sample #36*	-	+	206.9	375.5
Sample #39*	-	+	246.0	323.1
Sample #41**	+	-	301.0	252.8
Sample #43**	+	-	306.2	254.1

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### Cross-reactivity: 100 ng/mL Cutoff

Various potentially interfering substances were tested for interference with the assay. Test compounds were spiked into the drug-free urine pool to various concentrations and evaluated against the cutoff calibrator. The tables below list the concentration of each test compound that gave a response approximately equivalent to that of the cutoff calibrator (as positive) or the maximal concentration of the compound tested that gave a response below the response of the cutoff calibrator (as negative).

#### Hydrocodone and Metabolites:

Compound	Concentration Equivalent to Cutoff Concentration (ng/mL)	% Cross-reactivity
Hydrocodone	100	101.60%
Hydromorphone	125	85.08%
Hydromorphone Glucuronide	200	52.15%
Dihydrocodeine	2,000	4.98%
Norhydrocodone	18,000	0.57%

#### Structurally Related Compounds:

Compound	Concentration Equivalent to Cutoff Concentration (ng/mL)	% Cross-reactivity
6-mono acetylmorphine	6,500	1.6%
Codeine	3,000	3.5%
Codeine-6-Glucuronide	15,000	0.6%
Dextromethorphan	100,000	0.0%
Levorphanol	20,000	0.5%
Morphine	5,000	2.0%
Morphine 3-Glucuronide	13,000	0.8%
Morphine 6-Glucuronide	50,000	0.2%
Nalbuphine	100,000	0.0%
Naloxone	100,000	0.0%
Naltrexone	100,000	0.0%
Norbuprenorphine	100,000	0.0%
Norcodeine	100,000	0.0%
Noroxycodone	100,000	0.0%
Noroxymorphone	100,000	0.0%
Oxycodone	5,000	2.1%
Oxymorphone	7,500	1.3%
Thebaine	12,000	0.8%

No significant cross-reactivity with structurally un-related compounds was observed.

The labeling contains the list of structurally unrelated compounds that were tested.

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### Cross-reactivity: 300 ng/mL Cutoff

Various potentially interfering substances were tested for interference with the assay. Test compounds were spiked into the drug-free urine pool to various concentrations and evaluated against the cutoff calibrator. The tables below list the concentration of each test compound that gave a response approximately equivalent to that of the cutoff calibrator (as positive) or the maximal concentration of the compound tested that gave a response below the response of the cutoff calibrator (as negative).

#### Hydrocodone and Metabolites:

Compound	Concentration Equivalent to Cutoff Concentration (ng/mL)	% Cross- reactivity
Hydrocodone	300	99.70%
Hydromorphone	375	78.13%
Hydromorphone Glucuronide	625	49.15%
Dihydrocodeine	8,750	3.32%
Norhydrocodone	30,000	0.51%

#### Structurally Related Compounds:

Compound	Concentration Equivalent to Cutoff Concentration (ng/mL)	% Cross- reactivity
6-monoacetylmorphine	30,000	1.00%
Codeine	13,400	2.16%
Codeine-6-Glucuronide	80,000	0.37%
Dextromethorphan	100,000	0.00%
Levorphanol	100,000	0.32%
Morphine	22,000	1.30%
Morphine 3-Glucuronide	37,000	0.73%
Morphine 6-Glucuronide	100,000	0.17%
Nalbuphine	100,000	0.01%
Naloxone	100,000	0.03%
Naltrexone	100,000	0.01%
Norbuprenorphine	100,000	0.01%
Norcodeine	100,000	0.02%
Noroxycodone	100,000	0.02%
Noroxymorphone	100,000	0.27%
Oxycodone	20,000	0.08%
Oxymorphone	35,000	0.90%
Thebaine	25,000	0.75%

No significant cross-reactivity with structurally un-related compounds was observed.

The labeling contains the list of structurally unrelated compounds that were tested.

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### Interference: 100 ng/mL Cutoff

##### Endogenous Compound Interference Study: 100 ng/mL Cutoff

Various endogenous compounds were tested for interference with the assay. Test compounds were spiked into a pool of drug-free processed urine to the spiked concentrations listed in the table below. Each of these samples were split into three portions each and either left unspiked or further spiked to either 75 or 125 ng/mL of hydrocodone (the negative and positive control concentrations, respectively). These samples were then evaluated in both semi-quantitative or qualitative mode. The tables below list the positive or negative result of each test sample relative to the cutoff calibrator (positive above the cutoff calibrator and negative below the cutoff calibrator).

Endogenous Substance	Spiked Concentration (mg/dL)	Spiked Hydrocodone Concentration		
		0 ng/mL	75 Control ng/mL	125 Control ng/mL
Acetone	1000	Neg	Neg	Pos
Ascorbic Acid	500	Neg	Neg	Pos
Creatinine	500	Neg	Neg	Pos
Ethanol	1000	Neg	Neg	Pos
Galactose	10	Neg	Neg	Pos
γ-Globulin	500	Neg	Neg	Pos
Glucose	3000	Neg	Neg	Pos
Hemoglobin	300	Neg	Neg	Pos
HSA	500	Neg	Neg	Pos
Oxalic Acid	100	Neg	Neg	Pos
Riboflavin	0.3	Neg	Neg	Pos
Urea	6000	Neg	Neg	Pos
Sodium Chloride	1000	Neg	Neg	Pos

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### pH Interference Study: 100 ng/mL Cutoff

Pooled drug-free processed urine samples were adjusted to the target pH values (3 – 11) using 1N HCl or 1N NaOH. These samples were split into three portions each and either left unspiked or further spiked to either 75 or 125 ng/mL of hydrocodone (the negative and positive control concentrations, respectively). These samples were then evaluated in both semi-quantitative or qualitative mode. The tables below list the positive or negative result of each test sample relative to the cutoff calibrator (positive above the cutoff calibrator and negative below the cutoff calibrator).

pH	Spiked Hydrocodone Concentration		
	0 ng/mL	75 Control ng/mL	125 Control ng/mL
pH 3	Neg	Neg	Pos
pH 4	Neg	Neg	Pos
pH 5	Neg	Neg	Pos
pH 6	Neg	Neg	Pos
pH 7	Neg	Neg	Pos
pH 8	Neg	Neg	Pos
pH 9	Neg	Neg	Pos
pH 10	Neg	Neg	Pos
pH 11	Neg	Neg	Pos

#### Specific Gravity: 100 ng/mL Cutoff

Ten drug-free urine samples with specific gravity ranging in value from 1.000 to 1.030 were split into three portions each and either left un-spiked or further spiked to a final hydrocodone concentration of either 75 or 125 ng/mL (the negative and positive control concentrations, respectively). These samples were then evaluated in semi-quantitative and qualitative modes. The tables below list the positive or negative result of each test sample relative to the cutoff calibrator (positive above the cutoff calibrator and negative below the cutoff calibrator).

Specific Gravity	Spiked Hydrocodone Concentration		
	0 ng/mL	75 Control ng/mL	125 Control ng/mL
1.000	Neg	Neg	Pos
1.005	Neg	Neg	Pos
1.007	Neg	Neg	Pos
1.010	Neg	Neg	Pos
1.015	Neg	Neg	Pos
1.017	Neg	Neg	Pos
1.020	Neg	Neg	Pos
1.025	Neg	Neg	Pos
1.027	Neg	Neg	Pos
1.030	Neg	Neg	Pos

No significant undesired endogenous substance interference, pH interference, or specific gravity interference was observed at the 100 ng/mL Cutoff.

**Performance Characteristics Summary: (continued)**  
**AU480 Analyzer**

**Interference: 300 ng/mL Cutoff**

**Endogenous Compound Interference Study: 300 ng/mL Cutoff**

Various endogenous compounds were tested for interference with the assay. Test compounds were spiked into a pool of drug-free processed urine to the spiked concentrations listed in the table below. Each of these samples were split into three portions each and either left unspiked or further spiked to either 225 or 375 ng/mL of hydrocodone (the negative and positive control concentrations, respectively). These samples were then evaluated in both semi-quantitative or qualitative mode. The tables below list the positive or negative result of each test sample relative to the cutoff calibrator (positive above the cutoff calibrator and negative below the cutoff calibrator).

Endogenous Substance	Spiked Concentration (mg/dL)	Spiked Hydrocodone Concentration		
		0 ng/mL	225 Control ng/mL	375 Control ng/mL
Acetone	1000	Neg	Neg	Pos
Ascorbic Acid	500	Neg	Neg	Pos
Creatinine	500	Neg	Neg	Pos
Ethanol	1000	Neg	Neg	Pos
Galactose	10	Neg	Neg	Pos
γ-Globulin	500	Neg	Neg	Pos
Glucose	3000	Neg	Neg	Pos
Hemoglobin	300	Neg	Neg	Pos
HSA	500	Neg	Neg	Pos
Oxalic Acid	100	Neg	Neg	Pos
Riboflavin	0.3	Neg	Neg	Pos
Urea	6000	Neg	Neg	Pos
Sodium Chloride	1000	Neg	Neg	Pos

## Performance Characteristics Summary: (continued)

### AU480 Analyzer

#### pH Interference Study: 300 ng/mL Cutoff

Pooled drug-free processed urine samples were adjusted to the target pH values (3 – 11) using 1N HCl or 1N NaOH. These samples were split into three portions each and either left unspiked or further spiked to either 225 or 375 ng/mL of hydrocodone (the negative and positive control concentrations, respectively). These samples were then evaluated in both semi-quantitative or qualitative mode. The tables below list the positive or negative result of each test sample relative to the cutoff calibrator (positive above the cutoff calibrator and negative below the cutoff calibrator).

pH	Spiked Hydrocodone Concentration		
	0 ng/mL	225 Control ng/mL	375 Control ng/mL
pH 3	Neg	Neg	Pos
pH 4	Neg	Neg	Pos
pH 5	Neg	Neg	Pos
pH 6	Neg	Neg	Pos
pH 7	Neg	Neg	Pos
pH 8	Neg	Neg	Pos
pH 9	Neg	Neg	Pos
pH 10	Neg	Neg	Pos
pH 11	Neg	Neg	Pos

#### Specific Gravity: 300 ng/mL Cutoff

Ten drug-free urine samples with specific gravity ranging in value from 1.000 to 1.030 were split into three portions each and either left un-spiked or further spiked to a final hydrocodone concentration of either 225 or 375 ng/mL (the negative and positive control concentrations, respectively). These samples were then evaluated in semi-quantitative and qualitative modes. The tables below list the positive or negative result of each test sample relative to the cutoff calibrator (positive above the cutoff calibrator and negative below the cutoff calibrator).

Specific Gravity	Spiked Hydrocodone Concentration		
	0 ng/mL	225 Control ng/mL	375 Control ng/mL
1.000	Neg	Neg	Pos
1.005	Neg	Neg	Pos
1.007	Neg	Neg	Pos
1.010	Neg	Neg	Pos
1.015	Neg	Neg	Pos
1.017	Neg	Neg	Pos
1.020	Neg	Neg	Pos
1.025	Neg	Neg	Pos
1.027	Neg	Neg	Pos
1.030	Neg	Neg	Pos

No significant undesired endogenous substance interference, pH interference, or specific gravity interference was observed at the 300 ng/mL Cutoff.

## **Performance Characteristics Summary: (continued)**

### **AU480 Analyzer**

#### **Stability for Calibrators and Controls: 100 ng/mL Cutoff**

Current open-vial calibrator/control stability studies at Cold Temperature (2-8°C), Room temperature (~25 °C), and Accelerated Temperature (30°C) are on-going and have been carried out up to Day 92 at this time. Results from open-vial studies indicate that degradation is minimal at all three conditions up to Day 92 and based on the Arrhenius Equation, suggest an open-vial stability of up to 18 months.

Real-time data for closed-vial calibrator/control stability studies at Cold Temperature (2-8°C) are on-going have been carried out up to Day 114. Results from closed-vial studies indicate that degradation is minimal up to Day 114 as compared to Day 1.

#### **Stability for Calibrators and Controls: 300 ng/mL Cutoff**

Current open-vial calibrator/control stability studies at Cold Temperature (2-8°C), Room temperature (~25 °C), and Accelerated Temperature (30°C) are on-going and have been carried out up to Day 225 at this time. Results from open-vial studies indicate that degradation is minimal at all three conditions up to Day 225 and based on the Arrhenius Equation, suggest an open-vial stability of up to 18 months.

Real-time data for closed-vial calibrator/control stability studies at Cold Temperature (2-8°C) are on-going have been carried out up to Day 114. Results from closed-vial studies indicate that degradation is minimal up to Day 114 as compared to Day 1.

#### **Summary:**

The information provided in this pre-market notification demonstrates that the LZI Hydrocodone Enzyme Immunoassay is substantially equivalent to the legally marketed predicate device for its general intended use. Substantial equivalence was demonstrated through comparison of intended use and physical properties to the commercially available predicate device as confirmed by chromatography/mass spectrometry (GC/MS or LC/MS), an independent analytical method. The information supplied in this pre-market notification provides reasonable assurance that the LZI Hydrocodone Enzyme Immunoassay is safe and effective for its stated intended use.



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration  
10903 New Hampshire Avenue  
Document Control Center – WO66-G609  
Silver Spring, MD 20993-0002

June 13, 2014

LIN-ZHI INTERNATIONAL, INC.  
BERNICE LIN  
VP OPERATIONS  
670 ALMANOR AVE  
SUNNYVALE CA 94085

Re: K141055

Trade/Device Name: LZI Hydrocodone Enzyme Immunoassay,  
LZI Hydrocodone Drugs of Abuse (DAU) Calibrators,  
LZI Hydrocodone Drugs of Abuse (DAU) Controls

Regulation Number: 21 CFR 862.3650

Regulation Name: Opiate test system

Regulatory Class: II

Product Code: DJG, DLJ, LAS

Dated: April 21, 2014

Received: April 24, 2014

Dear Dr. Bernice Lin:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Parts 801 and 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the

electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

If you desire specific advice for your device on our labeling regulations (21 CFR Parts 801 and 809), please contact the Division of Industry and Consumer Education at its toll-free number (800) 638-2041 or (301) 796-7100 or at its Internet address

<http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm>. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to

<http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm> for the CDRH's Office of Surveillance and Biometrics/Division of Postmarket Surveillance.

You may obtain other general information on your responsibilities under the Act from the Division of Industry and Consumer Education at its toll-free number (800) 638-2041 or (301) 796-7100 or at its Internet address

<http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm>.

Sincerely yours,

**Courtney H. Lias -S**

Courtney H. Lias, Ph.D.

Director

Division of Chemistry and Toxicology Devices

Office of In Vitro Diagnostics

and Radiological Health

Center for Devices and Radiological Health

Enclosure

## Indications for Use

510(k) Number (if known)  
k141055

Device Name  
LZI Hydrocodone Enzyme Immunoassay and LZI Hydrocodone Calibrators and Controls

### Indications for Use (Describe)

The LZI Hydrocodone Enzyme Immunoassay is intended for the qualitative and semi-quantitative determination of hydrocodone in human urine at the cutoff values of 100 and 300 ng/mL when calibrated against hydrocodone. The assay is designed for prescription use with a number of automated clinical chemistry analyzers.

The semi-quantitative mode is for purposes of (1) enabling laboratories to determine an appropriate dilution of the specimen for confirmation by a confirmatory method such as GCMS and LCMS or (2) permitting laboratories to establish quality control procedures.

The LZI Hydrocodone Drugs of Abuse (DAU) Calibrators are for use as calibrators in the qualitative and semi-quantitative calibration of the LZI Hydrocodone Enzyme Immunoassay at the cutoff value of 100 and 300 ng/mL.

The LZI Hydrocodone Drugs of Abuse (DAU) Controls are for use as assayed quality control materials to monitor the precision of the LZI Hydrocodone Enzyme Immunoassay at the cutoff value of 100 and 300 ng/mL.

The assay provides only a preliminary analytical result. A more specific alternative chemical method must be used in order to obtain a confirmed analytical result. Gas or liquid chromatography/mass spectrometry (GC/MS or LC/MS) is the preferred confirmatory method. Clinical consideration and professional judgment should be exercised with any drug of abuse test result, particularly when the preliminary test result is positive

Type of Use (Select one or both, as applicable)

☒ Prescription Use (Part 21 CFR 801 Subpart D)

☐ Over-The-Counter Use (21 CFR 801 Subpart C)

**PLEASE DO NOT WRITE BELOW THIS LINE -- CONTINUE ON A SEPARATE PAGE IF NEEDED.**

### FOR FDA USE ONLY

Concurrence of Center for Devices and Radiological Health (CDRH) (Signature)

Denise Johnson-lyles -S

This section applies only to requirements of the Paperwork Reduction Act of 1995.

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